

LA MARTINIÈRE FOR GIRLS

REHEARSAL EXAMINATION—2025-26

MATHEMATICS

CLASS XII

Time : 3 Hours + 15 mins. reading time

Full Marks : 80

This paper consists of fifteen printed pages & one blank page.

(Candidates are allowed **additional 15 minutes** for only reading the paper.

They must **NOT** start writing during this time.)

This Question Paper consists of three sections A, B and C.

Candidates are required to attempt all questions from **Section A** and all questions

EITHER from **Section B OR Section C.**

Section A: Internal choice has been provided in **two questions of two marks each, two questions of four marks each and two questions of six marks each.**

Section B: Internal choice has been provided in **one question of two marks and one question of four marks.**

Section C: Internal choice has been provided in **one question of two marks and one question of four marks.**

All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.

The intended marks for questions or parts of questions are given in brackets [].
Mathematical tables and graph papers are provided.

SECTION A 65 MARKS

Question 1

In subparts (i) to (x) choose the correct options and in subparts (xi) to (xv), answer the questions as instructed.

(i) A and B are square matrices of order 3 such that $A + B = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \\ 2 & 1 & 3 \end{bmatrix}$ [1]

[Turn Over]

If A is a symmetric matrix, find the value of $|B|$.

- (a) -18
- (b) 0
- (c) 1
- (d) Insufficient data.

(ii) The value of which of the following integrals is zero?

[1]

I. $\int_0^1 x dx$ II. $\int_{-1}^1 x dx$ III. $\int_{-1}^1 x^2 dx$ IV. $\int_0^1 \log\left(\frac{x}{1-x}\right) dx$

- (a) II and IV only
- (b) II only
- (c) I, II and III only
- (d) III and IV only

(iii) The value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) + \sin^{-1}\left(\frac{1}{2}\right)$ is

[1]

- (a) $\frac{5\pi}{12}$
- (b) $\frac{7\pi}{12}$
- (c) $\frac{\pi}{4}$
- (d) $\frac{5\pi}{4}$

(iv) Let m and n be the degree and order of the differential equation

[1]

$$2x^3 \frac{dy}{dx} - 5 \left(\frac{d^2y}{dx^2} \right) = 6 \left(\frac{dy}{dx} \right)^3. \text{ Then}$$

- (a) $mn = 2$
- (b) $mn = 3$
- (c) $mn = 4$
- (d) $mn = 6$

(v) A dice is thrown three times. If the first throw is five, the probability of getting 14 as the sum of the three throws is

[1]

- (a) $\frac{1}{54}$
- (b) $\frac{1}{36}$

(c) $\frac{1}{18}$

(d) $\frac{1}{9}$

(vi) If $A = \begin{vmatrix} 2a & 3r & x \\ 4b & 6s & 2y \\ -2c & -3t & -z \end{vmatrix} = \lambda \begin{vmatrix} a & r & x \\ b & s & y \\ c & t & z \end{vmatrix}$, then the value of λ is

[1]

(a) -12

(b) -7

(c) 7

(d) 12

(vii) The function $f(x) = \frac{4-x^2}{4x-x^3}$ is

[1]

(a) Continuous for all $x \in \mathcal{R}$

(b) Discontinuous at only one point.

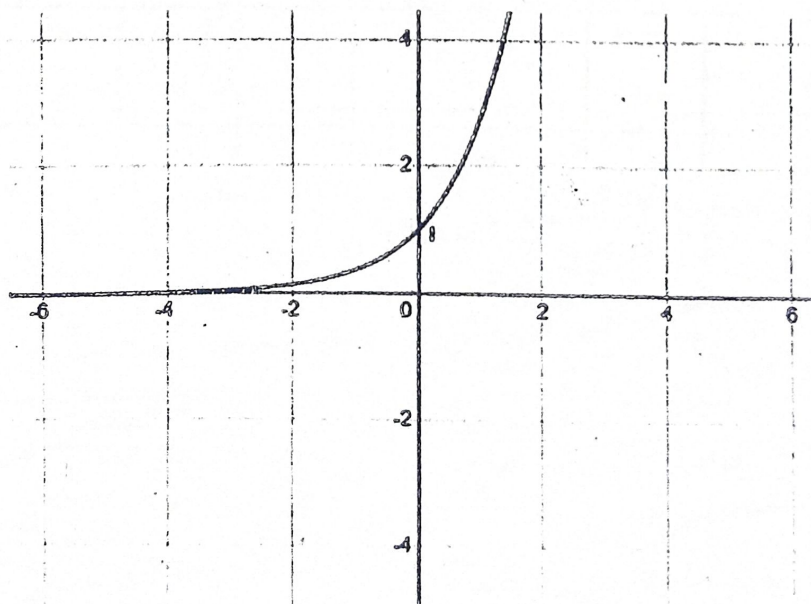
(c) Discontinuous at exactly two points.

(d) Discontinuous at exactly three points.

(viii) The graph of the double derivative of $y = e^x - 3$ is

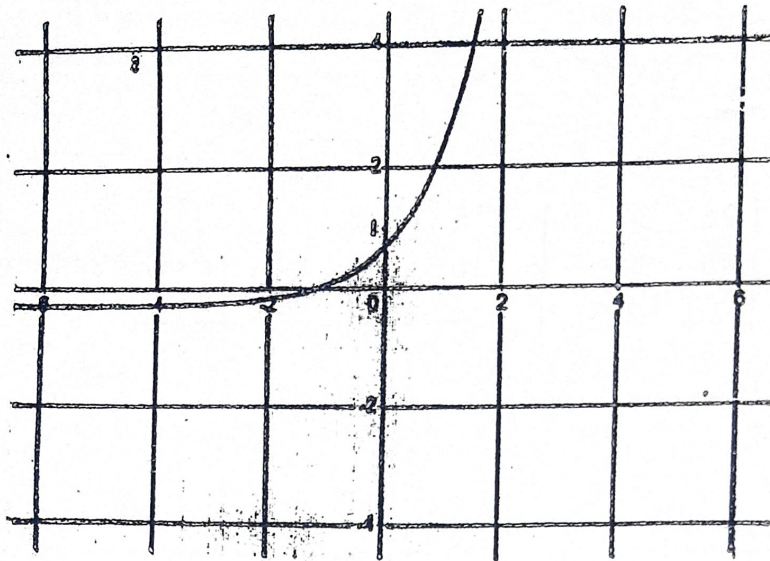
[1]

(a)

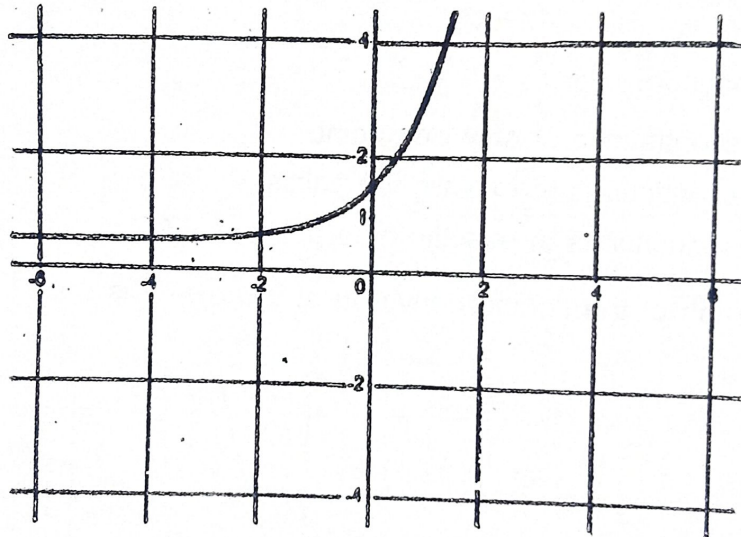


[Turn Over]

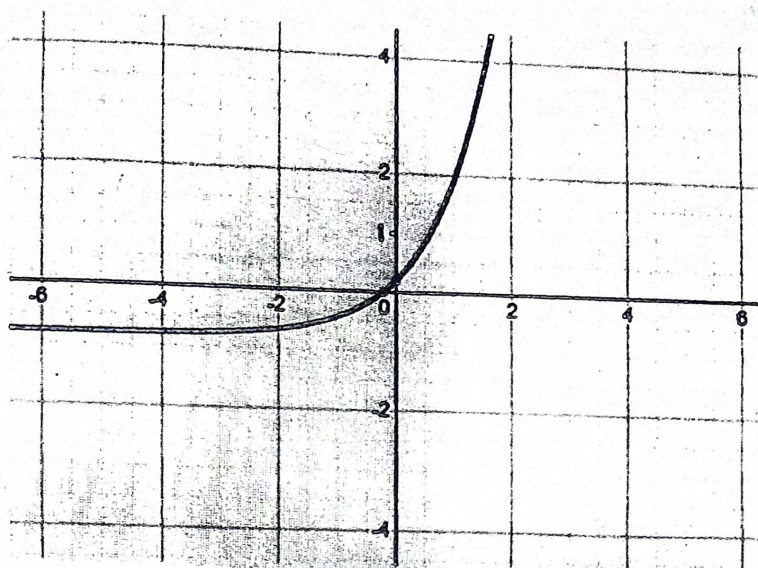
(b)



(c)



(d)



(ix) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined as $f(x) = x^4$.

[1]

Assertion (A) : f is onto but not one-one.

Reason (R) : Every element in the co-domain has at least one corresponding element in the domain.

Which one of the following options is correct?

- (a) A is true and R is the correct explanation for A
- (b) A is true and R is the not correct explanation for A
- (c) A is false but R is true.
- (d) Both A and R is false.

(x) **Statement 1 :** Scalar matrix $A = [a_{ij}] = \begin{cases} k; & i = j \\ 0; & i \neq j \end{cases}$ where k is a scalar, is an identity matrix when $k = 1$.

[1]

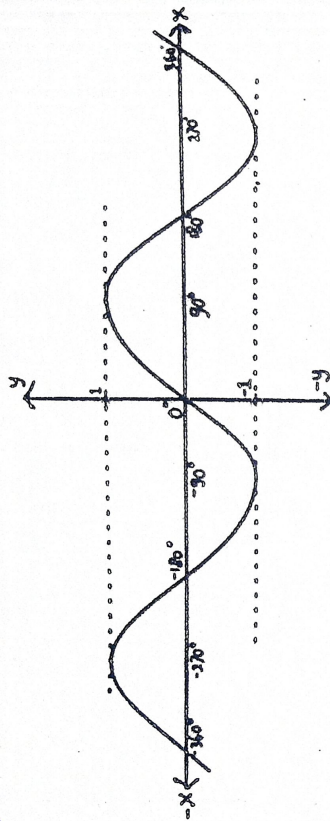
Statement 2 : Every identity matrix is not a scalar matrix.

Which of the above statements is/are correct?

- (a) Only 1
- (b) Only 2
- (c) Both 1 and 2
- (d) Neither 1 nor 2

[Turn Over]

- (xi) Shown below is a portion of the graph for $\sin \theta$. [1]



$$y = \sin \theta$$

What should the domain of the function be restricted to, so that the function is invertible?

- (xii) For what value of k will the determinant $\begin{bmatrix} 1 & 2 & 2 \\ 1 & k & 2 \\ 3 & 2 & -1 \end{bmatrix}$ not have an inverse? [1]

- (xiii) The Pinkathon, India's biggest women's run, was created to highlight the need for increased awareness about health issues that put women's lives at risk.

Let X be the set of all checkpoints for a pinkathon in Kolkata. The checkpoints A and B in X are said to be related, if the distance between them is not greater than five kilometres. Is this an equivalence relation? Justify. [1]

- (xiv) 70% of the total employee of a factory are men. Among the employees of that factory, 60% of men and 15% of women are technical assistants. If an employee chosen at random is found to be a technical assistant, then what is the probability that this employee is a man? [1]

- (xv) A random variable X has the following probability distribution: [1]

X	0	1	2	3	4	5	6	7
$P(X)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

Find the value of $P(4 < X < 7)$.

Question 2

- (a) Using substitution, find the derivative of $\cot^{-1} \frac{1+x}{1-x}$. [2]

OR

[1]

(p) Given, $f'(x) = \left[\frac{u(x)}{v(x)} \right]' = \frac{[v(x) \times u'(x) - u(x) \times v'(x)]}{[v(x)]^2}$ then for what condition will the

function $f(x) = \frac{ae^x + be^{-x}}{ce^x + de^{-x}}$ be an increasing function of x ? [2]

Question 3

Evaluate: $\int_0^\pi \frac{e^{\cos x}}{e^{\cos x} + e^{-\cos x}} dx$ [2]

Question 4

A particle moves along the curve $12y = x^3 - 4$. Find the points on the curve at which the y-coordinate is changing 4 times as fast as the x-coordinate. [2]

Question 5

(i) Evaluate : $\int e^{2x} (2 \sin 3x + 3 \cos 3x) dx$ [2]

OR

(ii) Evaluate : $\int_{0.2}^{3.5} [x] dx$

Question 6

If $\sin^{-1} \frac{2p}{1+p^2} - \cos^{-1} \frac{1-q^2}{1+q^2} = \tan^{-1} \frac{2x}{1-x^2}$, then what is x equal to? [2]

Question 7

In inverse trigonometry, the **principal value** is the value that falls within the principal value branch, which is the restricted range of the inverse trigonometric function where each value of the function corresponds to a unique angle.

Based on the given information, answer the following questions: [4]

(i) Evaluate: $\sin \left[\frac{\pi}{6} - \sin^{-1} \left(-\frac{\sqrt{3}}{2} \right) \right]$

(ii) Find the principal values of $\tan^{-1} \left(\tan \frac{5\pi}{4} \right)$

(iii) Prove that $\tan^{-1} \sqrt{x} = \frac{1}{2} \cos^{-1} \left(\frac{1-x}{1+x} \right)$

Question 8

Evaluate : $\int \frac{x^2 + 1}{x^4 - x^2 + 1} dx$ [4]

Question 9

(i) Let $f(x) = -2x^3 - 3x^2 + 12x + 20$. Given below is the graph of the derivative of $f(x)$. [4]

[Turn Over]



- a) Find the co-ordinates of A, B and C.
 b) What is/are the point(s) on the graph of $f(x)$ which have the same x-values as B and C called?
 c) For which values of x will $f(x)$ be increasing?

OR

- (ii) If $\log y = \tan^{-1}x$ and $(1 + x^2) \frac{d^2y}{dx^2} + (2x - a) \frac{dy}{dx} = 0$, find the value of a.

Question 10

- (i) A company uses three independent online payment gateways A, B and C. A customer's payment will go through as long as at least one gateway is working. Each gateway has a 90% chance of being operational at any given time. Assuming the gateways function independently, find the probability that a customer's payment will be successfully processed.

OR

- (ii) In a game, Anshu is asked to toss a die. If she gets a number more than four, she wins Rs 500 otherwise she loses Rs 100.

Anshu decides to throw the die thrice but she also decides that she will quit the moment she gets a number more than four. What is Anshu's expected win/loss?

Question 11

The sum of three numbers is 6. If we multiply third number by 3 and add second number

to it, we get 11. By adding first and third numbers, we get double of the second number.

Represent it algebraically and find the numbers using matrix method.

[6]

Question 12

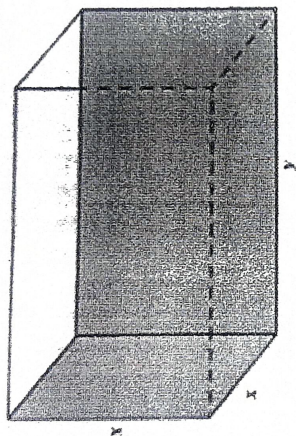
- (i) Find the particular solution of the following differential equation.
 $\cos^3 y \, dx + x \cos y \, dy = \sin y \, dy$ given $x = 1, y = 0$. [6]

OR

- (ii) Evaluate : $\int_0^{\frac{\pi}{2}} \frac{x}{1 + \cos x + \sin x} \, dx$

Question 13

- (i) Seema makes an open metal container in the shape of a cuboid, as shown in the following diagram. [6]



The container has height x m, width x m and length y m. The volume is 36 m^3 .

- Given that the outside surface area is minimum, find the height of the container.
- Seema paints the outside of the container with paint that costs Rs 200 per m^2 . If a tin of paint covers a surface area of 10 m^2 , find the total cost of paints required.

OR

- (ii) A logistics company is designing a new emergency supply route represented on a coordinate map by the straight line $2x + 3y = 6$.

The company wants to set up a temporary service outpost on this route. The cost of transporting goods to the outpost is directly proportional to its distance from the main warehouse, which is located at the origin $(0, 0)$.

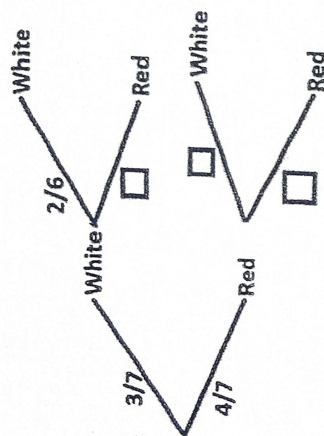
To minimise the daily fuel expenditure, the company decides that the outpost must be placed at the point on the route whose distance from the origin is the least. Find the coordinates of the point on the route that is closest to the origin. Also, state the minimum actual distance from the origin to the route.

[Turn Over]

Question 14

Bag A contains three white and four red balls.

a) Copy and complete the given tree diagram.



b) If two balls are drawn one after another without replacement, find the probability of drawing two white balls.

Bag B contains some white and some red balls. When two balls are chosen at random without replacement from bag B, the probability that they are both white is $\frac{2}{7}$.

An unbiased die is rolled. If 1 or 2 is obtained, two balls are chosen from bag A otherwise they are chosen from bag B.

c) Find the probability that the two balls are white.

d) Given that both balls are white, find the probability that they were chosen from bag A.

Question 15

SECTION B

15 MARKS

In subparts (i) and (ii) choose the correct options and in subparts (iii) to (v), answer the questions as instructed.

(i) If $\vec{a}, \vec{i} = \vec{a}, (\vec{i} + \vec{j}) = \vec{a}, (\vec{i} + \vec{j} + \vec{k}) = 1$, then $\vec{a}$ is equal to

(a) $\vec{0}$

(b) $\vec{i}$

(c) $\vec{j}$

(d) $\vec{i} + \vec{j} + \vec{k}$

[6]

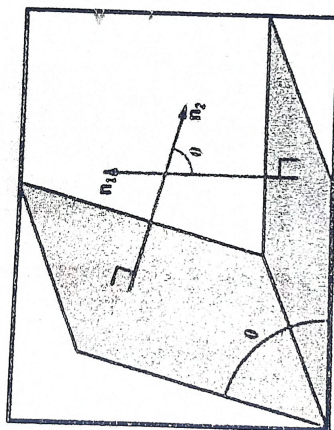
(ii) Find the equation of the plane passing through the point $(2, -1, 3)$ and containing the line $\frac{x-1}{3} = \frac{2-y}{4} = \frac{z+1}{2}$.

- (a) $2x - 2y + z = 9$
- (b) $2x + 2y + z = 5$
- (c) $11x + 2y + z + 21 = 0$
- (d) $11x - 2y + z + 17 = 0$

(iii) If OACB is a parallelogram with $\vec{OC} = \vec{a}$ and $\vec{AB} = \vec{b}$, then express $\vec{OA}$ in terms of $\vec{a}$ and $\vec{b}$.

(iv) Write down a unit vector in XY plane, making an angle of 30° in anticlockwise direction with the positive direction of X-axis.

(v) Find the angle between the normal to the planes $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 3$ and $\vec{r} \cdot (3\hat{i} + 2\hat{j} - \hat{k}) + 5 = 0$.



Question 16

(i) The position vectors of two points A and B are $\hat{i} + \hat{j} + \hat{k}$ and $5\hat{i} - 3\hat{j} + \hat{k}$. Find a unit vector in direction of $\vec{AB}$, and find the direction cosines of $\vec{AB}$. What angles does $\vec{AB}$ make with the coordinate axes? [2]

OR

(ii) Find the unit vector perpendicular to the plane of two vectors $\vec{a}$ and $\vec{b}$, where $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$

[Turn Over]

Question 17

- (i) Imagine you are at a point A, a café you visit often. Your friend is at the point B, a bookstore a few blocks away on a straight road. You want to meet your friend at a point on the line joining the café and the bookstore. Another friend, who is at home on the other side of the same road represented by point P, also wants to join. You decide to determine the exact meeting point by finding the foot of the perpendicular from P on the line joining the café and the bookstore. Given that co-ordinates of the café (A) are (1, 2, 4), of the bookstore (B) are (3, 4, 5) and the home are (2, 1, 3), find the location of the meeting point. [4]

OR

- (ii) Two friends are planning a road trip. One friend stays in City A represented by the position vector $-2\hat{i} + 3\hat{j} + 5\hat{k}$. The trip will start from City A and proceed towards the City B represented by the position vector $\hat{i} + 2\hat{j} + 3\hat{k}$. The friend living in City C represented by the position vector $7\hat{i} - \hat{k}$ will join when the first friend passes through her city.
- (a) Find the vector equation for the straight path between the cities A and B.
 (b) Hence, find out whether the three cities lie on the same straight path.
 (c) If the two friends now plan to travel $\sqrt{126}$ units along the vector $\overline{AB}$ from the City C, find the position vector of the destination point.

Question 18

Draw a rough sketch and find the area enclosed by the curve $y = -x^2$ and the line $x + y + 2 = 0$. [4]

SECTION C

Question 19

In subparts (i) and (ii) choose the correct options and in subparts (iii) to (v), answer the questions as instructed

[15 MARKS]

- (i) The total cost function for x units of a commodity is given by $C(x) = x^3 + x^2 - 8x + 4$. Find the slope of average cost function. [5]

(a) $3x^2 + 2x - 8$

(b) $2x + 1 - \frac{4}{x^2}$

(c) $x^2 + x - 8 + \frac{4}{x}$

(d) $x^2 + x - 8$

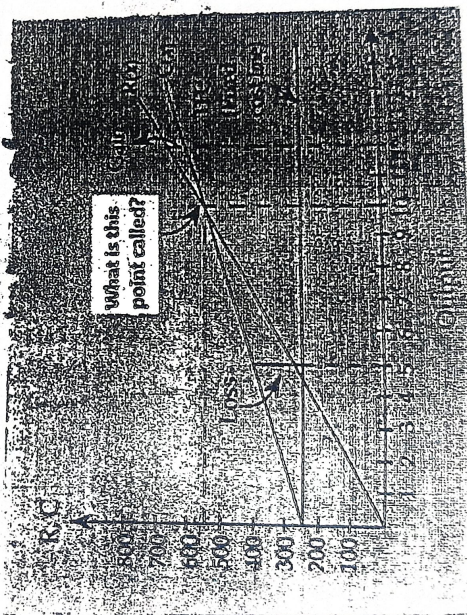
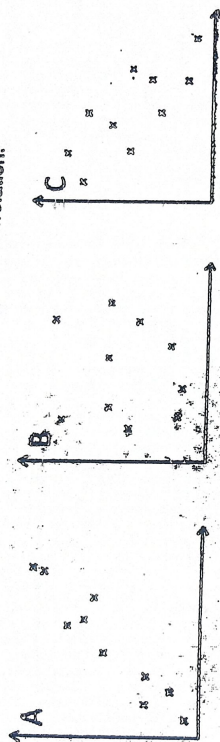
(ii) Consider the following statements:

Statement 1 : $|r|$ is the arithmetic mean between b_{yx} and b_{xy}
 Statement 2 : If one of b_{yx} and b_{xy} is numerically greater than one, then the other is numerically smaller than one.

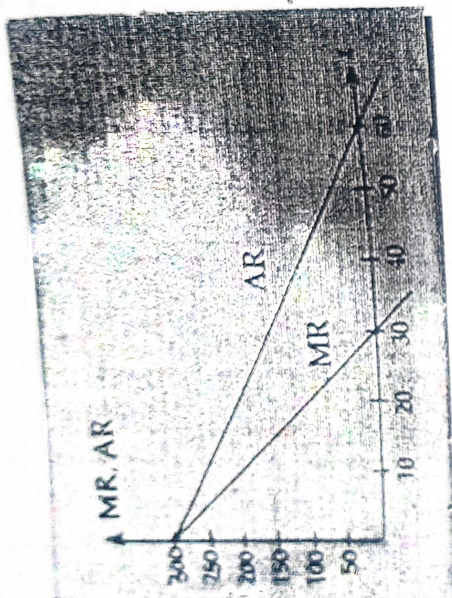
Which one of the following options is correct?

- (a) Both statements are true.
- (b) Both statements are false.
- (c) Statement 1 is true but statement 2 is false.
- (d) Statement 1 is false but statement 2 is true.

(iii) For each of the scatter diagrams given below, state whether or not there is a correlation and, if so, state the strength and type of correlation.



[Turn Over]



From the graph we see that after 30 units MR becomes negative. What does this imply?

Question 20

- (i) If the average cost is constant at all levels of output, what is the relationship between the average cost and the marginal cost. Explain. [2]

OR

- (ii) The cost of production per day for x items is given by $C(x) = x^3 - x^2 - x + 3500$. Compute the additional cost incurred when the output is increased from 10 to 11 items.

Question 21

- (i) A track coach records an athlete's daily sprint-training duration (x hours) and the corresponding performance rating (y) over ten training days. From the observations, the following totals were obtained:

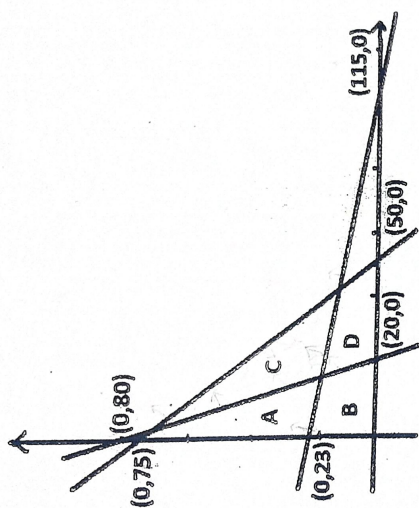
- $\Sigma x = 55$
- $\Sigma y = 55$
- $\Sigma xy = 350$
- $\Sigma x^2 = 385$

Assuming that training duration and performance rating are linearly correlated, predict the athlete's expected performance rating on a day when the training duration is 6 hours.

OR

- (ii) The two lines of regression are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$ and the variance of x is 12. Find the variance of y and the coefficient of correlation.

Question 22



- i) In the given figure, which is the feasible region represented by the constraints $4x + y \geq 80$, $x + 5y \geq 115$, $3x + 2y \leq 150$, $x \geq 0$, $y \geq 0$?
- ii) Find the corner points of the feasible region.
- iii) Maximize the objective function Z , given $Z = x + y$ subject to the given constraints.
- iv) What changes in the constraints will make the feasible region unbounded?